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LEPA and LESA Fight It Out

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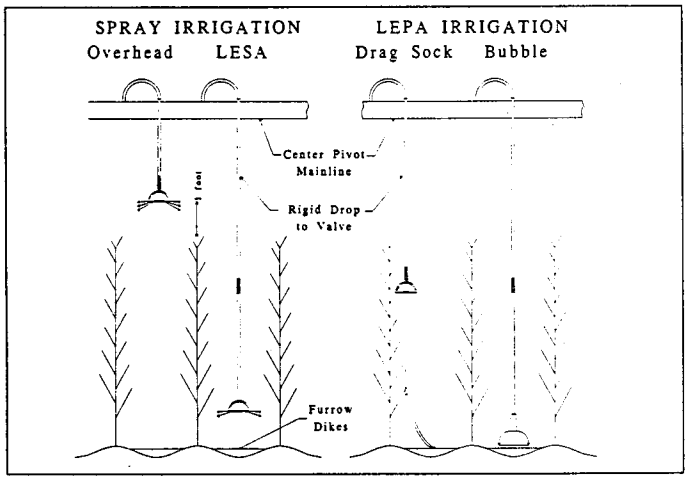
Shown here is the LEPA sock sprinkler method on grain sorghum at Bushland, TX. Photos courtesy: USDA-ARS

The number of center pivot irrigation systems has rapidly increased in the Southern High Plains. In fact, the High Plains Underground Water Conservation District No. 1 in Lubbock, TX (serving the area from south of Lubbock to Amarillo), recently reported a 104-percent increase in the number of center pivot systems from 1990 to 1995. Many of these systems are equipped with LEPA (Low Energy Precision Application) or LESA (Low Elevation Spray Application) applicators located near the ground.

LEPA devices are usually positioned over alternate furrows with an 80-inch spacing for cotton, or a 60-inch spacing for grain crops in the northern part of the region. Both sprinkler methods have high instantaneous applications rates — usually well above the soil infiltration rate.

Tillage methods such as chiseling or furrow diking, or a cropping system such as no-till, conservation or ridge till is required to hold back the applied water. This permits infiltration while lessen surface redistribution and field runoff. Furrow dikes have added value because they retain rainfall from high-intensity summer storms. They can practically eliminate field runoff from rainfall events less than 1.5 inches.

LEPA application greatly reduces evaporation of droplets from wetted canopies, but LEPA devices are more expensive than spray heads. Irrigators use LEPA in both a bubble mode and drag sock mode. The bubble mode produces a thin, umbrella-looking sheet of water. Double-ended and single-ended socks and large diameter (six-inch) layflat plastic irrigation hose are used for the drag mode. To control the flow rate, the drag socks are usually attached to LEPA or spray heads using a half-inch or three-quarter-inch plastic hose.



Four irrigation methods are possible for center pivot systems. These include overhead and LESA spray irrigation, and drag sock and bubble LEPA irrigation

The layflat plastic hose can be gathered over a spray head and held in place with a plastic wire tie. Double-ended socks need to be dragged with the entire sock in contact with the ground. These socks then spill water on one side of a furrow dike or the other, but will not erode the dike. Single-ended socks or layflat hose must have four to six inches dragging in the furrow bottom. These devices will "hang" on a dike and then "jump" over the dike with minimum erosion.

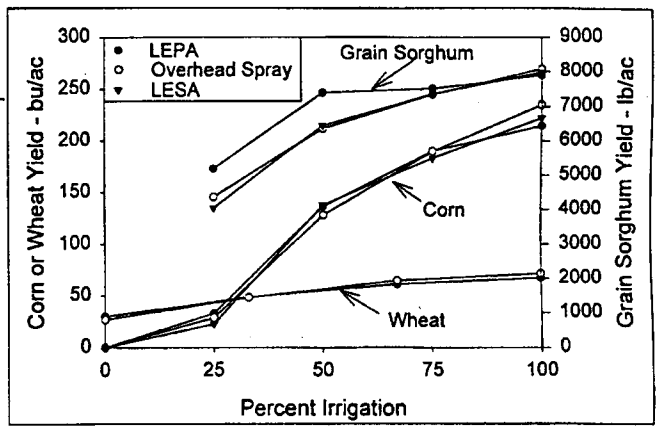
Yield Differences Between LEPA and LESA

USDA researchers at the Conservation and Production Research Laboratory at Bushland, TX, compared two LEPA methods (bubble and double-ended drag sock), with LESA and overhead spray. Full irrigation and deficit irrigation as a percent of full irrigation were used with all sprinkler devices. All spray and LEPA devices were nozzled for the same flow

rate and were spaced 60 inches apart over alternate furrows. The LEPA and LESA devices were suspended without weights from 3/4-inch hose. All plots were furrow-diked to minimize surface redistribution and plot runoff.

When viewing full irrigation across the two cropping years with each of the three crops, grain yields were slightly larger with spray than with LEPA, but not statistically significant. Two-year average grain sorghum yields were 7,900 pounds per acre with LEPA and 8,150 pounds per acre with spray. For corn, the comparable averages were 209 bushels per acre with LEPA and 221 bushels per acre with spray. For wheat, the averages were 67 bushels per acre with LEPA and 72 bushels per acre with spray. The crop yields are above average for this area, but are typical of those obtained by progressive growers.

With deficit irrigation, LEPA was highly efficient for grain sorghum, but for the other two crops there was little difference between LEPA and spray. At the 50 percent irrigation amount with grain sorghum, two-year average grain yields were 7,400 pounds per acre with LEPA and 6,400 pounds per acre with spray.



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One surprising outcome was the small grain yield differences between the LESA and overhead spray methods. For example, with the 1992 grain sorghum crop, yields

averaged across all irrigation amounts were 7,130 pounds per acre with LESA and 7,110 pounds per acre with overhead spray.

For the 1993 grain sorghum, yields were 5,790 pounds per acre with LESA and 5,970 pounds per acre with overhead spray. Comparable average two-year yields for corn were 109 bushels/acre with LESA and 112 bushels with overhead spray.

LESA Disadvantages

LESA spray heads often became entangled in the crop and sprayed water into the entire crop canopy. As a result, water losses from the crop canopy were probably similar for the two spray methods although the spray head location was entirely different.

LESA was not used with wheat, because of the difficulty using spray heads within a closely-spaced crop. Spring irrigations for corn and sorghum were minimized by seeding into fields that were previously fallowed.

The fully-irrigated crop received one-inch irrigations. Deficit-irrigated crops received a percentage of the one-inch irrigations on the same date. For corn, two to three inches per week were necessary to maintain soil water above yield-limiting levels. Two inches per week was usually sufficient for grain sorghum and wheat. This would correspond to 5.4 to 8.1 gallons per minute (GPM) per acre for corn and 5.4 GPM per acre for grain sorghum and wheat.

The grain crops in this study were grown with cultural practices (variety, fertility, plant population and weed and insect control) similar to those used for high-yield on-farm irrigation. Corn and grain sorghum were planted on 30-inch spaced beds. Wheat was flat-planted in ten-inch spaced rows.

With a fully-wetted crop canopy and ample irrigation capacity, vertical spray head placement does not have a major impact on irrigation efficiency.

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